

THE DISTRIBUTION OF THE MINERAL ELE-
MENTS IN THE ANIMAL BODY AS INFLU-
ENCED BY AGE AND CONDITION

by

JOHN L. NIERMAN, A.B., A.M.

SUBMITTED IN PARTIAL FULFILMENT OF
THE REQUIREMENTS FOR THE DEGREE
OF DOCTOR OF PHILOSOPHY

in the

GRADUATE SCHOOL

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BIOGRAPHICAL

The author of this dissertation was born near Howell, St. Charles County, Missouri, February 11, 1887. His early days were spent in a rural community, where he attended a rural school, a German Lutheran parochial school and an academy. Early in his life he chose teaching as a profession, was granted a certificate to teach in 1906, and began by teaching a rural school. He attended the State Teachers' College at Kirksville, Missouri, for three years and was graduated in 1910. In the same year he was married to Augusta L. Mueller of Augusta, Missouri. He held the following teaching positions in the public schools of the State: Principal of the Town School, Augusta, Missouri, 1908-1910; principal of the High School, Wentzville, Missouri, 1910-1914; superintendent of schools, Hopkins, Missouri, 1914-1917. He came to the University of Missouri in 1917 and received the A. B. degree in 1918. The following year he studied under Dr. Herman Schlundt, under whose direction a dissertation for the degree of Master of Arts entitled, "The Concentration of Barium Radium Mesothorium Bromides by Fractional Crystallization" was prepared. The degree was awarded in 1920. In the spring of 1919 he was elected Head of the Department of Chemistry in Sweet Briar College, Sweet Briar, Virginia. He resigned this position in the spring of 1922 and came to the University of Missouri to take up his studies for the degree of Doctor of Philosophy. With the completion of this dissertation the author wishes to express his indebtedness and thanks to the various members of the Agricultural Chemistry Staff, to Dr. L. D. Haigh for assistance in the analytical work, and especially to Dr. A. G. Hogan under whose direction and guidance this work was completed.

STUDIES IN ANIMAL NUTRITION

VI. The Distribution of the Mineral Elements in the Animal Body as Influenced by Age and Condition

ABSTRACT.—Cattle were subjected to a complete mineral analysis, including sodium, potassium, calcium, magnesium, iron, phosphorus, chlorine, and sulphur. Thirty-three animals, ranging from birth to four years of age, were analysed. The ash of the calves is constant in composition, and that of the corresponding composites of lean and fat, hair and hide, internal organs, blood, and skeletons of the older animals has a practically constant composition. The data do not indicate that the mineral content of the lean and fat, or of the hide and hair, is affected by age or condition. There is a distinct tendency for the percentages of all the mineral elements in the internal organs to decrease with age. Most of the mineral constituents of the blood are not affected by age, but there is a tendency for one of the most important, sodium, to decrease in the older animals. This tendency may also apply to chlorine, but this is more uncertain. Of the mineral elements in the skeleton, calcium, phosphorus, and magnesium increase in percentage with age. No marked variations of the other elements were noted.

In the spring of 1907, there was begun at the University of Missouri Agricultural Experiment Station an extensive investigation known as the "Use of Food Experiment." This was outlined as "A proposed inquiry into the composition of the carcasses of cattle of different ages, different stages of development, and different conditions of fatness, or an attempt to ascertain to what uses steers of different ages, on different rations, and in different conditions put their food."

A considerable number of these experimental animals were killed and then subjected to analysis for nitrogen, water, fat, and ash. In addition, numerous samples were retained, in order that at a later date they might be used for a complete ash analysis. It is with these mineral analyses that we are now concerned.

EXPERIMENTAL

Experimental Animals.—The calves and calf embryos that were analyzed will be discussed separately from the other animals, partly because the method of sampling was different, but chiefly because they formed a separate and minor portion of the investigation as a whole. The animals have been described in an earlier publication* and it should be consulted for complete details. For the sake of convenience two tables have been reproduced which contain most of the essential facts.

In the way of special comment it is necessary to point out, that, though calves 11A and 11B of the Jersey group were still-born, they were

*Research Bulletin 38, Missouri Agricultural Experiment Station, 1920.

regarded as entirely normal. The mother of calf 85A, indicated as abnormal, received for a considerable period a ration deficient in calcium, and this deficiency may explain the abnormality of the calf. This calf is described as follows: "The lower jaw was undeveloped, there were no eyes, and hair was growing from the eye sockets. Twelve hours after birth it was slaughtered." Calf 22A may also be regarded as abnormal, in that it was decidedly weak at birth.

TABLE 1.—WEIGHTS OF JERSEY CALVES AS OBTAINED FOR THIS EXPERIMENT

* Description	Pounds	Grams
Fetus (full term) of Cow 2 (279 days) 2X	69.81	31,665
Calf of Cow 11 (still born) 11A	56.00	24,040
Calf of Cow 11 (still born) 11B	70.40	31,933
Calf of Cow 22 (5 days old) 22A	52.20	23,677
Calf of Heifer 85 (abnormal) 85A	30.00	13,608

TABLE 2.—LIVE WEIGHT OF HEREFORD CALVES AT BIRTH

Calf No.	Plane of feeding	Live weight	
		pounds	grams
560B	High Plane	88.25	40,029
562B	High Plane	82.38	37,364
560D	High Plane	71.75	32,545
562C	High Plane	87.75	39,803
563A	Medium Plane	89.64	40,661
564C	Medium Plane	85.00	38,555
567B	Low Plane	63.00	28,576
566B	Low Plane	89.00	40,370
568C	Low Plane	73.80	33,478

The Hereford calves were born of mothers used in an investigation of the relation of nutrition to reproduction. The dams were on three planes of nutrition, described as follows: "The animals on the high plane of nutrition were allowed to eat enough to fatten as well as to make thrifty growth. Those on the medium plane, enough to make thrifty growth without getting fat; and those on the low plane were fed scantily" All calves here reported seemed to be normal in development. Calves from the dams on the high plane of nutrition had a smoother appearance than those on the medium or low plane, but calves from the dams on the medium plane of nutrition appeared to be as active and vigorous as calves generally are at birth. Calf 566B, from the low plane, was practically as heavy as any calf used in the experiment.

The analyses of all these calves have been reported in Research Bulletin 38. Reference to that publication shows that the ash content of the calves does not vary much, averaging about 4.5 per cent. For the complete mineral analyses, composite samples were used, each representing the entire body.

The animals used in the second part of this study were Hereford and Shorthorn steers, ranging in age from 3 to 48 months. They were also from three different groups. Group I animals were fed all they would consume, Group II animals were fed for maximum growth without permitting the laying on of much fat, and Group III was fed for scanty or retarded growth.

The Group II steers gained about one pound daily for the first two years, and the Group III cattle gained about 0.69 pounds per day.

TABLE 3.—DESCRIPTION OF STEERS USED IN THIS STUDY

No. of animal	Age in months	Group	Live weight in grams	Warm empty weight in grams
* 556	3	I	111,489	98,133
557	5	I	204,934	172,797
547	8	I	206,175	171,448
527	40	I	842,841	786,005
513	44	I	853,007	771,142
501	48	I	883,480	814,914
554	3	II	87,456	78,071
552	5	II	116,491	99,349
550	8	II	147,202	112,112
526	40	II	497,846	427,995
502	44	II	506,878	444,424
512	48	II	548,050	493,877
555	3	III	84,725	71,078
548	5	III	99,255	85,988
558	8	III	108,191	89,999
524	40	III	362,260	322,234
509	44	III	439,814	391,461
500	48	III	457,786	407,833

They were under close observation at all times during the experimental period and complete descriptions, including feed and weight records, slaughter house notes, and chemical analyses, may be had by referring to Research Bulletins 43, 54, and 55, of this Station. For our immediate purpose, however, the material summarized in the following table will suffice.

Composite samples of the entire bodies of these animals had not been preserved, but samples of lean and fat, hide and hair, internal organs, blood, and skeleton, had been preserved, in the expectation that at a later date they would be used for a mineral analysis. Unfortunately some of them disappeared while they were in storage, but the series is fairly complete.

In calculating the total ash present in the animal body we have filled the gaps by substituting the composition of the same tissue from a similar animal. Such a substitution is regrettable, but we do not believe the totals are more than slightly affected.

Ashing the Sample.—The samples to be ashed usually weighed about 500 grams. Those that had been preserved in a half-charred con-

dition were placed in porcelain casseroles of good quality and then set on a thick sand bath so that the temperature could be easily controlled. Those that had been preserved in alcohol were heated at a low temperature to drive off the alcohol, then transferred to casseroles and ashed.

The casseroles containing the dried or half-charred samples were kept on the sand bath at a low temperature until thoroughly charred. They were then carefully broken into smaller pieces, again heated at a low temperature until smoking ceased, and the process continued until the samples no longer caked. A heavy glass rod was used to stir them and also to break up the larger pieces. The residue could now be broken into pieces the size of a grain of wheat and the heat was gradually increased and the stirring continued at intervals. The larger lumps were broken up with the glass rod and when necessary the whole sample was transferred to a mortar and ground. It was found advisable, however, not to grind the material too fine as this prevents proper aeration and thus retards the ashing process. The heat was now gradually increased but at no time was it allowed to pass a dull red. After continuing in this way for a week or ten days the casseroles were placed over the open flame. Rogers ring burners were now used as with these it is possible to control the heat perfectly and the flame is spread over the entire bottom of the dish. The heating must be carefully watched at this stage or fusion of the material will take place if the heat becomes too great. Stirring is continued at intervals and the sample is spread over the entire bottom of the dish so that air may have access to each particle. This process is continued until the sample is completely ashed. A grayish-white ash is obtained from samples of lean and fat, and a red ash from blood, and hide with hair. From four to six weeks are required for the ashing of a sample.

By this method the skeleton is easily ashed and a carbon-free ash is obtained. Composite samples of the entire body of the animal are also easily ashed in this way as there is sufficient calcium present to prevent fusion. In this case the ash has a reddish tint due to the presence of iron. Blood is rather difficult to ash to a point where it is free from carbon. This ash had a bright red color, and appeared to be free from carbon, but on digestion with hydrochloric acid considerable carbon was found. The ash of the internal organs also contained some carbon.

After the ashing was completed the samples were placed in sealed glass containers.

Methods of Analysis.—From two to five grams of the ash, depending on the amount available, were weighed out in duplicate into 250-cc. beakers, digested for several hours in a strong solution of hydrochloric acid, then evaporated to dryness and completely dehydrated by heating

on a sand bath for two hours. They were then again taken up in strong hydrochloric acid, digested for two hours, and again dehydrated. After the second digestion only the carbon, sand, and silica remained as an insoluble residue. The samples were then taken up with water, 5 to 10 cc. of hydrochloric acid added, and filtered through hardened filter paper into 250-cc. measuring flasks, the residues thoroughly washed with hot water, and the filtrates made up to the mark. From this volume aliquots were drawn for the determination of iron, sulphur, calcium, magnesium, phosphorus, sodium, and potassium, while carbon, sand and silica were determined in the residue. Chlorine was determined in a portion of the original ash.

We are not including a description of the analytical methods used, since in practically all cases we followed the well known conventional procedures. These are described sufficiently in the *Methods of Analysis of the Association of Official Agricultural Chemists*.

Mention should be made of the fact that the iron determinations are to be regarded as maximum values. The grinding and mixing machines were all made of iron or steel and it is possible that these were a source of contamination.

As will be noted in the tables that are to appear later, both sulphur and chlorine are reported twice. One determination of each is based on the complete analysis of the ash, while the other is based on the analysis of the tissue itself for which purpose a number of specimens had been preserved. It is evident that so far as sulphur is concerned only the latter determinations have any real significance for, as is well known, organic sulphur is largely lost on ignition. This may be true to some extent of chlorine, but Tables VII, XI, XV, XVIII, and XXI show clearly that, of the two, sulphur is much more readily lost. In fact if extreme care is taken that the temperature does not rise higher than is necessary to give a faintly perceptible red, we doubt that there would be a significant loss of chlorine.

Unfortunately many of the samples were lost making it impossible to obtain strict accuracy in estimating the quantity of sulphur or chlorine present in the various tissues or in the entire body of the animals. Also some of the samples were so small that the number was further reduced by difficulties encountered in the course of the analysis. Our practice therefore has been to calculate the average percentage of sulphur and chlorine in the fat-free material of the tissues analyzed, and use this average in calculating the total quantity of sulphur and chlorine in the various parts of the animals, and in the total animal (Tables XXII and XXIII). This method of calculation is not ideal but we feel sure that our results are of the correct magnitude. The points on the graphs

(Figs. 1 to 6) represent actual analyses, so our results for total sulphur and chlorine were omitted. The values given there were obtained by analysis of the ash; hence all of the sulphur results and many for chlorine are too low.

Two or three procedures were used in determining chlorine, but in our experience the method described* for chlorine in plants was the most satisfactory. Sulphur is readily determined by igniting with the usual fusion mixtures, or with sodium peroxide in a Parr sulphur bomb.

Calculations.—It is unnecessary to discuss in detail the calculations based on our analyses, but it may be helpful to explain briefly the method of preparing the tabular data. In order that the explanation may be followed more easily a concrete example will be used.

Tables I to IV give the data on the calves studied in the first part of this investigation. It will be recalled that a complete sample representing the entire body was prepared from each calf and ashed. Table I shows the percentage composition of the ash of these composites. It was then a simple matter to compute the percentage of the mineral elements in each animal on the fresh weight basis. These results are shown in Table II. Since a comparison of the mineral content of animal bodies is unsatisfactory if they are not equally fat, the percentage of the elements was next calculated to the fat-free basis. These data are shown in Table III. Finally, to facilitate comparisons, the percentages of the elements on the fat-free basis were plotted against plane of nutrition. Fig. I gives these graphs for the calves.

The data on steers are reported in a similar manner. As already stated composite samples of the entire bodies of these animals were not available for analysis, so separate composites of lean and fat, hair and hide, internal organs, blood, and skeleton were ashed. The percentage composition of the ash of lean and fat is reported in Table V. Tables VI and VII show the percentages of the mineral elements on the fresh weight and fat-free basis respectively. As the ash of hair and hide, and ash of the blood contained a considerable quantity of carbon, and the hair and hide ash contained, in addition, varying amounts of sand, the percentages of the ash constituents of these samples were calculated to the carbon- and sand-free basis and to exactly 100. From these results the percentages of the constituents on the fresh weight basis and on the fat-free basis were calculated in the same manner as for the calves. Graphs showing the changes in the mineral content with age and condition are given for each tissue. (Figures 2 to 6).

Finally tables were assembled showing the weight of each mineral constituent in each tissue and in the entire body of the animal, and then

*Official and Tentative Methods of Analysis of the Association of Official Agricultural Chemists.

the percentages of each element in the entire body were calculated. These tables may serve as a further basis of comparison and are useful in finding the quantity of any mineral element in an animal of definite weight.

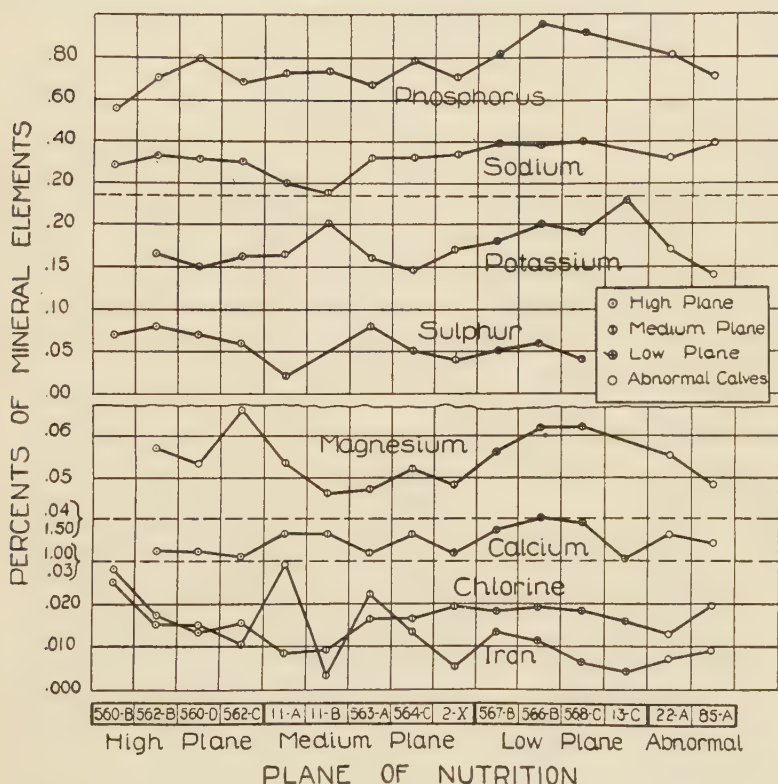


Fig. 1.—Percentages of Mineral Elements in the Entire Bodies of Calves on the Fat Free Basis.

DISCUSSION OF THE DATA

The Calves.—On referring to Table I it will be observed that the percentage of ash in the entire bodies of calves from dams on different planes of nutrition does not vary greatly and on the average is about 4.5 per cent. Nor does this ash, when separated into its constituents show any regular variations that can be correlated with the condition of the dam. There are differences in the percentages of the constituents, but these are individual differences and can not be correlated with the method of feeding the mother. The greater part of the ash is calcium phosphate. Even calf 85A, from the dam fed a ration deficient in calcium, shows a normal calcium content in the ash, and the other constituents of

the ash of this calf show no great irregularity. The same general differences appear when the calves are compared on the fresh weight basis and on the fat-free basis. A better comparison can be made by referring to Fig. 1. The element phosphorus shows some increase in the animals that were under poorer feeding conditions, a relation also reported in Research Bulletin 38, a separate study of these same calves.

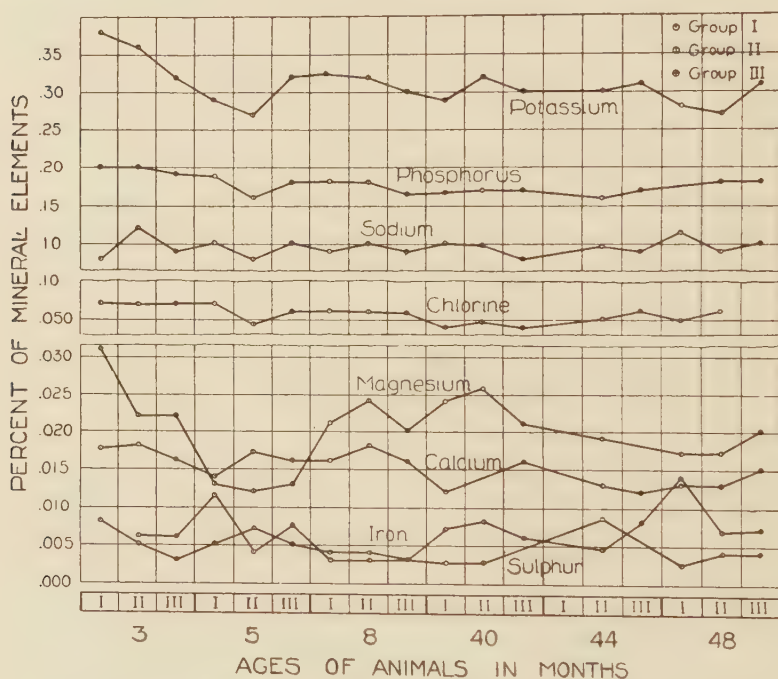


Fig. 2.—Percentage of Mineral Elements in Lean and Fat on Fat Free Basis.

The Steers.—Table V shows the complete analysis of the ash of lean and fat. The percentage of ash in the fresh weight of lean and fat (column 4) decreases with age. It is 1.13 per cent in the three-months old steer of Group I, and falls to 0.49 per cent in the 48 months old animal of the same group. A similar decrease takes place in Groups II and III, but the decrease is less. It is evident that the composition of the ash of all the samples is about the same. The percentage of K_2O exceeds the percentage of N_2O and is about the same as the percentage of P_2O_5 .

Table VI gives the percentages of the mineral elements on the fresh weight basis. As the percentage of fat in the lean and fat composites varies from 5 to 80 per cent, and is much affected by age and condition,

the percentages of the elements on the fat-free basis, (Table VII) will be considerably higher than on the fresh weight basis. The relation of the mineral content, on the fat-free basis, to age and condition is shown in Fig. 2. Individual differences are apparent, especially in the magnesium content, but there are no consistent variations.

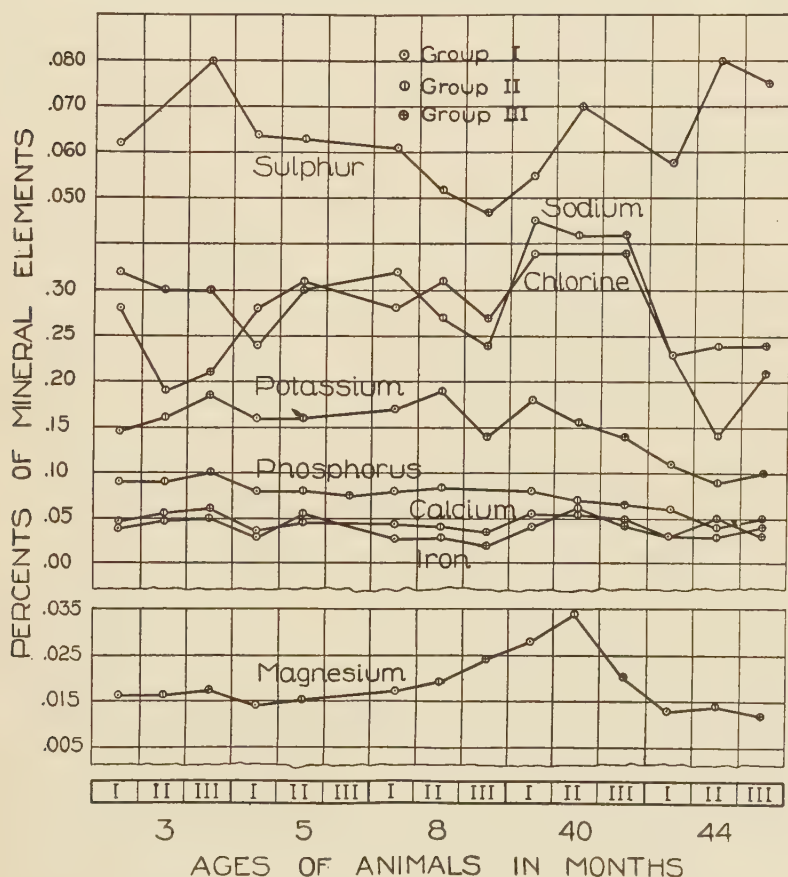


Fig. 3.—Percentages of Mineral Elements in Hair and Hide on the Fat Free Basis.

The percentage composition of the crude ash of hair and hide is shown in Table VIII, while Table IX shows the composition of the pure ash (i. e. carbon and sand free). The percentage of ash in the fresh hair and hide sample is on the average about 1.30 per cent and seems to decrease slightly with age. Sodium and chlorine show the highest percentages and the amount of sodium exceeds that of each of the other elements. As might be expected, there is a higher percentage of sulphur in the

hair and hide, than in any other division of the animal. In Table X the percentages of the mineral elements are reported on the fresh weight basis while in Table XI they are reported on the fat-free basis. The percentage of fat in the hide and hair samples increases with age but the increase is less marked in the animals of Groups II and III. A comparison of the mineral content with respect to age and condition is best made by referring to Fig. 3. The percentages of phosphorus, calcium and iron are fairly constant for the different animals. It is difficult to draw definite conclusions as to the effect of age and condition on the mineral content of hide and hair, and it is probably little influenced by these factors.

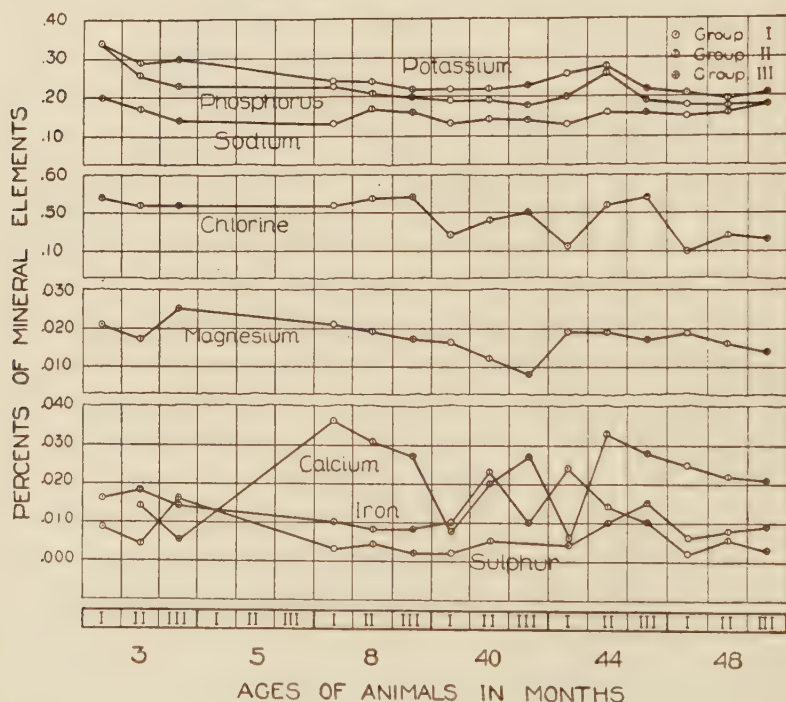


Fig. 4.—Percentage of Mineral Elements in the Internal Organs on the Fat Free Basis.

Table XII gives the percentage composition of the crude ash of the internal organs, and in Table XIII the percentages are calculated on the carbon- and sand-free basis. The percentage of ash in the fresh internal organs decreases with age and is less in Group II animals than in Group I animals, and less in Group III than in Group II. The ash of the internal organs is principally sodium and potassium phosphate and there is more potassium than sodium. While there are considerable variations

in the percentages of the same constituents, they cannot be correlated with age or plane of nutrition, and we conclude that the percentage composition of the ash of internal organs is approximately the same for all the samples. Table XIV gives the percentages of the mineral elements on the fresh weight, and in Table XV they are reported on the fat-free basis. The relation of the mineral content to age and condition is best seen in Fig. 4. All the elements seem to decrease with age.

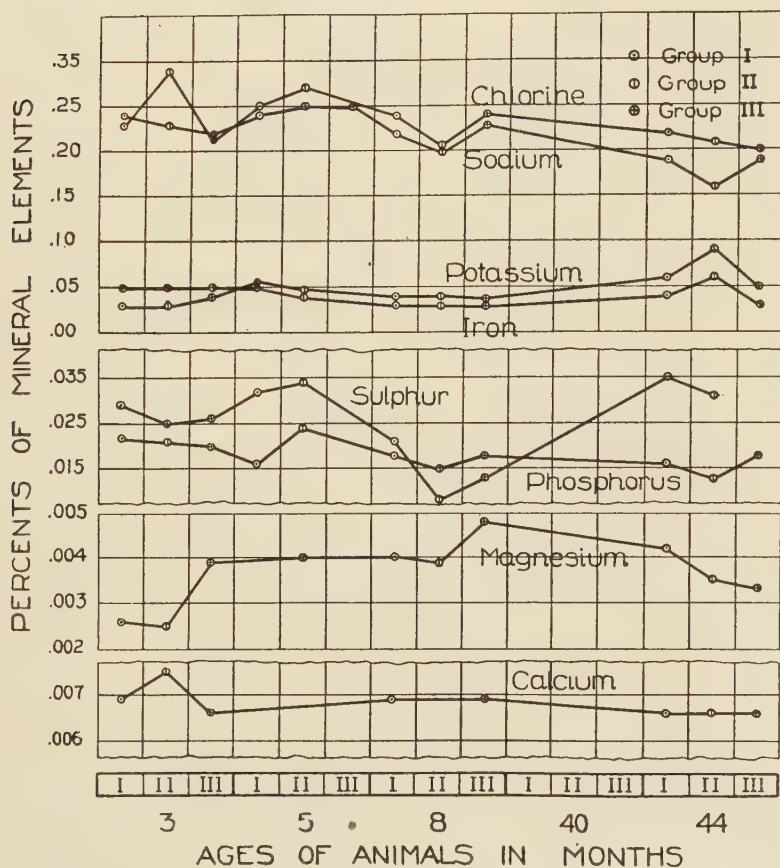


Fig. 5.—Percentages of Mineral Elements in Blood

Table XVI shows the percentage composition of the crude ash of blood, and in Table XVII the percentages are reported on the carbon and sand free basis. The percentage of ash in fresh blood is low, shows little variation with age and condition, and this ash consists largely of sodium and chlorine. There is much more sodium than potassium, and

of course there is more iron in blood ash than in any of the other samples studied.

When the percentages of the mineral elements in fresh blood are calculated (Table XVIII), individual differences in the percentages of the elements are rather small. As blood contains little fat a comparison of the different samples was made on the fresh weight basis and Fig. 5 gives the results graphically. Sodium and chlorine seem to decrease with age and are usually lower in the scantily fed animals.

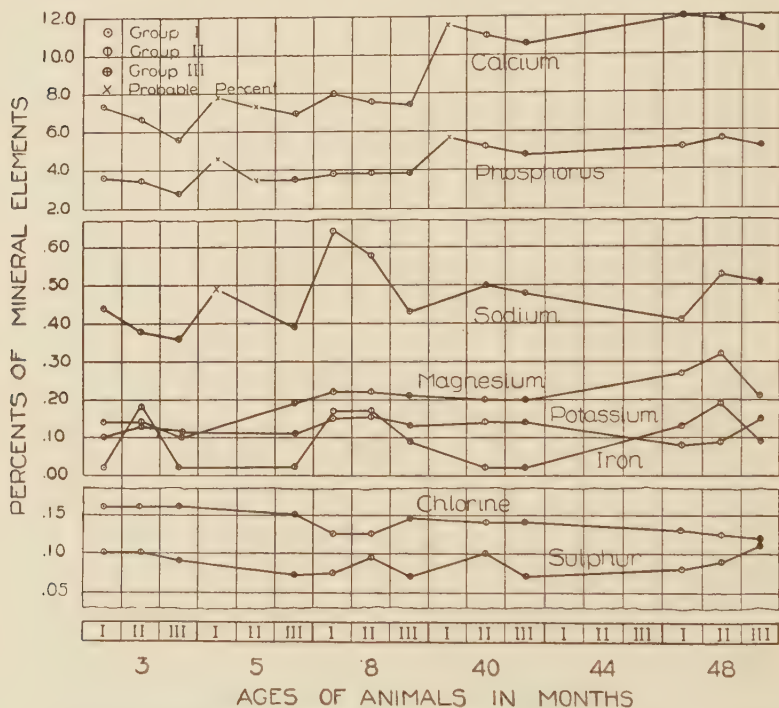


Fig. 6.—Percentage of Mineral Elements in the Skeleton on the Fat Free Basis.

The composition of the ash of the skeleton is shown in Table XIX. The principal constituent is calcium phosphate, and it comprises about 90 per cent of the total. The skeleton contains more sodium than potassium as is also true of the blood and the hide and hair. In contrast to this it will be remembered that the lean and fat, also the internal organs, contain more potassium than sodium. The percentage of ash in the fresh bone increases rapidly in the older animals, and is possibly higher in the better fed animals. This increase is chiefly accounted for by the increasing percentage of calcium phosphate, though as would be expected magnesium increases also. Any change in the relative propor-

tions of the other elements is doubtful. As the percentage of fat in the skeleton is higher for the older animals than for the young ones the percentage of the elements on the fat-free basis shows even a greater increase with age than on the fresh basis. Some of the data are presented in Fig. 6.

Table XXII gives the weight in grams of each mineral element in each tissue, and from these the weight of each element in the entire warm empty weight is calculated for each steer. Finally the percentage of each element in the entire body (warm empty weight) was calculated and reported in Table XXIII.

SUMMARY

Cattle were subjected to a complete mineral analysis, including sodium, potassium, calcium, magnesium, iron, phosphorus, chlorine, and sulphur.

The ages of the animals analyzed ranged from birth to 4 years. In all there were 15 newly born calves and 18 steers.

The newly born calves were from mothers on different planes of nutrition, and the steers analyzed were themselves on widely different planes of nutrition.

The ash of the entire bodies of the calves is constant in composition. The mineral content of the entire body, on the fat-free basis, is fairly constant, and cannot be correlated with the condition of the dam.

In regard to the steers, the ash of the corresponding composites of lean and fat, hide and hair, internal organs, blood, and skeleton, has a practically constant composition in all the animals.

The data do not indicate that the mineral content of the lean and fat, or of the hide and hair, is affected by age or condition.

There is a distinct tendency for the percentages of all the mineral elements in the internal organs to decrease with age. Most of the mineral constituents of the blood are not affected by age, but there is a tendency for one of the most important, sodium, to decrease in the older animals. This tendency may also apply to chlorine, but this is more uncertain.

Of the mineral elements in the skeleton, calcium, phosphorus, and magnesium increase in percentage with age. No marked variations of the other elements were noted.

TABLE I.—PERCENTAGE COMPOSITION OF THE ASH OF CALVES

No. of calf	Per-centage ash in sample	Plane of nutrition	Na ₂ O	K ₂ O	CaO	Fe ₂ O ₃	MgO	P ₂ O ₅	Cl	SO ₃	SiO ₂	CO ₂	Total	Deduct O=Cl	Total
2X	4.062		7.28	4.82	40.29	.22	1.89	38.75	4.56	2.26	.32	.30	100.69	1.02	99.67
11A	4.096		6.23	4.65	43.11	.98	2.07	39.38	1.95	1.11	.64	.19	100.28	.44	99.84
11B	4.288		5.96	5.72	41.07	.97	1.75	38.46	2.24	3.11	.30	.75	100.33	.50	99.83
22A	4.570	Subnormal	5.12	4.60	44.02	.22	1.97	40.07	2.71	1.86	.69	.42	101.68	.61	101.07
85A	4.270	Abnormal	7.13	4.24	41.75	.30	1.79	37.48	4.39	3.04	1.05	.47	101.64	.99	100.65
13X	3.180	Abnormal	6.02	8.52	37.71	.20	1.15	34.67	4.81	4.03	None	5.59	102.70	1.08	101.62
560B	4.003	High	9.27	12.00	32.00	.91	1.16	30.84	6.88	4.39	None	3.22	100.67	1.55	99.12
562B	4.285	High	7.07	5.19	38.80	.45	2.14	36.61	3.96	4.73	2.49	.35	101.79	.89	100.90
560D	4.426	High	5.69	4.86	43.07	.45	1.89	39.27	2.82	4.02	.17	.69	102.93	.64	102.29
562C	3.895	High	6.78	5.05	40.60	.36	2.70	39.05	3.58	4.19	.37	.43	103.11	.81	102.30
563A	4.317	Medium	6.00	4.68	37.52	.71	1.76	34.47	3.55	4.47	7.37	.40	100.93	.80	100.13
564C	4.534	Medium	6.19	4.35	43.88	.37	1.85	38.81	3.50	2.60	.23	.40	102.16	.79	101.37
567B	4.974	Low	6.47	4.41	38.70	.38	1.83	36.83	3.60	2.48	4.06	.30	99.06	.81	98.25
566B	5.502	Low	6.21	4.05	44.47	.28	1.84	38.42	3.46	2.69	.22	.60	102.24	.78	101.46
568C	5.188	Low	6.62	4.86	43.82	.18	1.93	39.20	3.46	1.85	.15	.31	102.38	.78	101.60

TABLE II.—PERCENTAGE OF MINERAL ELEMENTS IN THE ENTIRE BODIES OF CALVES CALCULATED ON THE FRESH WEIGHT BASIS

No. of calf	Plane of Nutrition	Na	K	Ca	Fe	Mg	P	Cl	S	Cl*	S*
2X		.2194	.1625	1.169	.006	.046	.686	.1852	.036	.18	.19
11A		.1891	.1580	1.262	.028	.051	.703	.0798	.018	.21	.21
11B		.1692	.2030	1.258	.029	.045	.719	.0946	.053	.17	.15
22A		.1736	.1745	1.437	.007	.054	.798	.1238	.034	.28	.44
85A	Subnormal Abnormal (Calcium deficient)	.2259	.1502	1.274	.009	.046	.698	.1874	.052	---	---
13X	Low	.1419	.2240	.857	.004	.022	.481	.1529	.051	---	---
560B	High	.2753	.4050	.915	.025	.028	.538	.2754	.070	---	---
562B	High	.2247	.1846	1.181	.013	.055	.684	.1696	.081	---	---
560D	High	.1868	.1786	1.362	.014	.051	.758	.1248	.071	---	---
562C	High	.1959	.1633	1.130	.010	.063	.663	.1394	.065	---	---
563A	Medium	.1922	.1677	1.157	.021	.046	.649	.1532	.077	---	---
564C	Medium	.2083	.1998	1.735	.012	.051	.767	.1586	.047	.16	.17
567B	Low	.2387	.1821	1.375	.013	.055	.799	.1790	.049	---	---
566B	Low	.2537	.1849	1.748	.011	.061	.922	.1903	.059	.19	.17
568C	Low	.2548	.2093	1.624	.006	.060	.887	.1795	.038	.20	.20

*Percentage of chlorine and sulphur as determined in the fresh material.

TABLE III.—PERCENTAGE OF THE MINERAL ELEMENTS IN THE ENTIRE BODIES CALCULATED ON THE FAT-FREE BASIS

No. of calf	Plane of nutrition of dams	Percentage of fat in fresh samples	Na	K	Ca	Fe	Mg	P	Cl	S	Cl*	S*
2X		3.384	.2270	.1681	1.210	.006	.047	.710	.191	.037	.19	.20
11A		4.591	.1980	.1656	1.322	.029	.053	.737	.083	.018	.22	.22
11B		3.494	.1965	.2103	1.304	.030	.046	.745	.098	.549	.18	.15
22A		1.951	.1770	.1779	1.466	.007	.055	.813	.126	.346	.29	.45
85A	Subnormal	4.006	.2353	.1564	1.327	.009	.047	.727	.195	.541	---	---
13X	Abnormal	2.553	.1456	.2299	.879	.004	.023	.493	.156	.523	---	---
560B	Low	3.829	.2860	.4211	.951	.026	.029	.559	.286	.072	---	---
562B	High	4.024	.2341	.1923	1.230	.014	.057	.712	.176	.084	---	---
560D	High	4.402	.1954	.1869	1.425	.015	.053	.792	.130	.074	---	---
562C	High	4.364	.2048	.1707	1.181	.010	.065	.693	.145	.067	---	---
563A	Medium	3.959	.2001	.1746	1.205	.022	.047	.675	.159	.801	---	---
564C	Medium	3.386	.2156	.1694	1.471	.012	.052	.793	.164	.048	.17	.18
567B	Low	3.243	.2466	.1881	1.421	.013	.056	.825	.185	.050	---	---
566B	Low	2.543	.2603	.1897	1.794	.011	.062	.946	.195	.060	.20	.18
568C	Low	3.729	.2646	.2174	1.687	.006	.062	.921	.186	.039	.21	.21
Avg.											.20	.19

*Percentage of chlorine and sulphur as determined in the fresh material.

TABLE IV.—WEIGHTS OF THE MINERAL ELEMENTS IN THE ENTIRE BODIES OF CALVES (IN GRAMS)

No. of calf	Live weight in grams	Plane of nutrition	Na	K	Ca	Fe	Mg	P	Cl	S	Cl	S
2X	31,665	Medium	69.47	51.46	370.16	1.90	14.63	217.28	58.64	11.40	61.2	58.1
11A	24,090	Medium	45.55	38.06	304.02	6.73	12.26	169.40	19.18	4.33	46.0	43.7
11B	31,933	Medium	60.54	64.82	401.72	9.26	14.37	229.60	30.66	16.92	61.6	58.6
22A	23,677	Subnormal	41.10	41.32	340.24	1.66	12.79	188.94	29.31	8.05	46.4	44.1
85A	13,608	Abnormal	30.74	20.44	173.37	1.22	6.26	94.98	25.47	7.08	26.1	24.8
13X	13,975	Low	19.83	31.30	119.77	.56	3.07	67.22	21.37	7.13	27.2	25.9
560B	40,029	High	110.20	162.12	366.26	10.01	11.21	215.36	110.24	28.02	77.0	73.1
562B	37,364	High	83.96	68.97	441.27	4.86	20.55	255.57	63.37	30.26	71.7	68.1
560D	42,545	High	79.47	75.99	579.46	5.96	21.70	322.49	53.10	30.21	81.3	77.3
562C	39,804	High	77.98	65.00	449.79	3.98	25.08	263.90	55.49	25.87	76.1	72.3
563A	40,661	Medium	78.15	68.19	470.45	8.54	18.70	263.89	62.29	31.31	78.1	74.2
564C	38,555	Medium	80.31	63.11	547.87	4.63	19.66	295.72	61.15	18.12	74.5	70.8
567B	28,576	Low	68.21	52.04	392.92	3.71	15.72	228.32	51.15	14.00	55.3	52.5
566B	40,370	Low	102.42	74.64	705.67	4.44	24.63	372.22	76.83	23.82	78.7	74.8
568C	33,478	Low	85.30	70.07	543.68	2.01	20.09	296.95	60.09	12.72	64.5	61.2

TABLE VI.—PERCENTAGE OF MINERAL ELEMENTS IN LEAN AND FAT CALCULATED ON THE FRESH WEIGHT BASIS

Group	No. of steer	Na	K	Ca	Fe	Mg	P	Cl	S	Cl*	S*
I	556	.0936	.3519	.0057	.0081	.0286	.1862	.0668	.0164	---	---
I	557	.0819	.2515	.0108	.0037	.0102	.1424	.0550	.0101	---	---
I	547	.0763	.2671	.0136	.0036	.0176	.1467	.0539	.0027	---	---
I	527	.0514	.1415	.0057	.0037	.0119	.0803	.0182	.0014	.045	---
I	513	---	---	---	---	---	---	---	---	---	---
I	501	.0539	.1316	.0062	.0069	.0081	.0773	.0228	.0016	.063	---
II	554	.1123	.3446	.0176	.0052	.0212	.1965	.0732	.0061	---	---
II	552	.0711	.2467	.0162	.0065	.0112	.1402	.0418	.0035	---	.190
II	550	.0875	.2745	.0159	.0030	.0212	.1575	.0525	.0026	---	---
II	526	.0758	.2493	.0072	.0067	.0201	.1343	.0379	.0025	---	---
II	502	.0769	.2494	.0105	.0037	.0163	.1325	.0423	.0077	---	---
II	512	.0673	.2273	.0096	.0047	.0128	.1289	.0448	.0030	.034	.120
III	555	.0899	.3137	.0158	.0035	.0219	.1839	.0736	.0062	---	---
III	548	.0954	.3053	.0153	.0050	.0125	.1735	.0574	.0079	---	---
III	558	.0824	.2884	.0154	.0031	.0191	.1586	.0547	.0029	---	---
III	524	.0746	.2764	.0146	.0060	.0194	.1571	.0405	.0350	---	---
III	509	.0763	.2575	.0066	.0072	.0102	.1408	.0526	.0140	.042	.120
III	500	.0863	.2596	.0130	.0057	.0164	.1507	.0160	.0035	---	---
	A†	---	---	---	---	---	---	---	---	.055	.099
	B†	---	---	---	---	---	---	---	---	.071	.076

*Chlorine and sulphur as determined in the fresh material

†These steers were used in another investigation and are not described in this publication.

TABLE VII.—PERCENTAGE OF MINERAL ELEMENTS IN LEAN AND FAT CALCULATED ON THE FAT-FREE BASIS

Group	No. of Steer	Percent- age of fat in sample	Na	K	Ca	Fe	Mg	P	Cl	S	Cl*	S*
I	556	9.14	.1030	.3873	.0063	.0089	.0315	.2049	.0735	.0180	---	---
I	557	24.82	.1089	.3345	.0144	.0049	.0136	.1894	.0732	.0134	---	---
I	547	17.92	.0930	.3254	.0166	.0044	.0214	.1787	.0657	.0033	---	---
I	527	51.80	.1066	.2936	.0118	.0077	.0247	.1666	.0378	.0029	.093	---
I	513	49.37	---	---	---	---	---	---	---	---	---	---
I	501	53.12	.1150	.2807	.0132	.0147	.0173	.1649	.0486	.0030	.134	---
II	554	5.94	.1194	.3664	.0187	.0055	.0225	.2089	.0778	.0065	---	---
II	552	9.45	.0785	.2724	.0179	.0072	.0124	.1548	.0462	.0038	---	.21
II	550	14.30	.1021	.3203	.0186	.0035	.0247	.1838	.0613	.0030	---	---
II	526	22.88	.0983	.3233	.0093	.0086	.0259	.1741	.0491	.0032	---	---
II	502	18.22	.0940	.3050	.0128	.0045	.0199	.1620	.0517	.0042	---	---
II	512	28.29	.0939	.3170	.0134	.0066	.0178	.1798	.0625	.0042	.047	.16
III	555	3.26	.0929	.3243	.0153	.0036	.0226	.1901	.0761	.0064	---	---
III	548	4.73	.1001	.3205	.0161	.0052	.0131	.1821	.0602	.0083	---	---
III	558	5.52	.0872	.3052	.0163	.0033	.0202	.1821	.0579	.0031	---	---
III	524	8.86	.0819	.3033	.0160	.0066	.0213	.1724	.0444	.0384	---	---
III	509	16.96	.0919	.3101	.0079	.0087	.0123	.1696	.0633	.0169	.051	.15
III	500	17.23	.1043	.3136	.0157	.0069	.0198	.1821	.0193	.0042	---	---
A		37.92	---	---	---	---	---	---	---	---	.089	.16
B		33.72	---	---	---	---	---	---	---	---	.107	.12
Avg.		---	---	---	---	---	---	---	---	---	.087	.16

*Chlorine and sulphur as determined in the fresh material.

TABLE VIII.—PERCENTAGE COMPOSITION OF THE ASH OF HIDE AND HAIR

[illegible]

TABLE IX.—PERCENTAGE COMPOSITION OF THE ASH OF HIDE AND HAIR CALCULATED ON THE CARBON-AND-SAND-FREE BASIS AND TO EXACTLY 100

Group	No. of Steer	Percentage of ash in sample	N ₂ O	K ₂ O	CaO	Fe ₂ O ₃	MgO	P ₂ O ₅	Cl	SO ₃	SiO ₂	CO ₂	Total	Deduct O = Cl	Total
I	556	1.38	30.86	12.46	4.53	4.60	1.96	15.33	19.94	11.13	3.66	tr.	104.46	4.46	100
I	557	1.17	26.22	15.93	4.29	3.08	1.94	15.17	22.68	13.03	2.49	.24	105.07	5.07	100
I	547	1.30	32.09	15.57	4.58	2.82	2.06	14.87	21.32	11.46	None	None	104.77	4.77	100
I	527	1.37	32.58	14.45	5.15	3.85	3.00	12.64	22.19	8.96	2.14	None	104.95	4.95	100
I	513	.94	29.29	12.88	4.21	4.61	2.01	13.05	22.16	14.04	2.65	.04	104.94	4.94	100
I	501	1.52	---	---	---	---	---	---	---	---	---	---	---	---	---
II	554	1.44	27.83	13.48	5.34	4.55	1.88	15.44	12.47	17.70	4.08	None	102.77	2.77	100
II	552	1.41	28.01	13.09	4.51	5.41	1.73	16.13	21.51	10.79	3.40	.23	104.83	4.83	100
II	550	1.31	26.90	17.60	4.56	2.74	2.38	15.02	23.29	9.76	2.99	None	105.25	5.25	100
II	526	1.44	31.85	12.25	5.18	5.38	3.77	9.49	23.64	11.60	2.12	None	105.28	5.28	100
II	502	.98	31.64	10.33	4.37	6.60	2.31	10.86	13.80	20.45	2.75	None	103.10	3.10	100
II	512	1.16	---	---	---	---	---	---	---	---	---	---	---	---	---
III	555	1.48	27.91	15.08	5.58	4.93	1.96	15.96	14.37	14.00	3.59	None	103.38	3.38	100
III	548	1.35	---	---	---	---	---	---	---	---	---	---	---	---	---
III	558	1.13	28.51	14.44	4.46	2.69	3.50	15.61	24.35	10.35	1.54	None	105.45	5.45	100
III	524	1.58	29.24	10.38	4.47	3.86	2.03	12.23	17.55	21.30	2.84	None	103.94	3.94	100
III	500	1.07	---	---	---	---	---	---	---	---	---	---	---	---	---
III	509	1.02	31.13	11.59	4.98	4.03	1.93	10.64	20.74	17.93	1.66	None	104.63	4.63	100

TABLE X.—PERCENTAGE OF THE MINERAL ELEMENTS IN THE HIDE AND HAIR CALCULATED ON THE FRESH WEIGHT BASIS

Group	No. of Steer	Na	K	Ca	Fe	Mg	P	Cl	S	Cl*	S*
I	556	.3160	.1427	.0447	.0443	.0163	.0923	.2751	.0614	---	.42
I	557	.2276	.1547	.0359	.0252	.0137	.0774	.2654	.0610	---	.31
I	547	.3095	.1680	.0425	.0256	.0162	.0845	.2772	.0596	---	---
I	527	.3311	.1644	.0504	.0369	.0248	.0755	.3040	.0491	---	.39
I	513	.2042	.1005	.0283	.0303	.0114	.0535	.2083	.0528	---	---
I	501	---	---	---	---	---	---	---	---	---	---
II	554	.2974	.1611	.0550	.0458	.0163	.0970	.1796	.1020	---	.38
II	552	.3010	.1574	.0454	.0534	.0151	.0994	.3033	.0626	---	.36
II	550	.2614	.1914	.0427	.0251	.0188	.0860	.3051	.0511	---	---
II	526	.3402	.1464	.0533	.0542	.0327	.0596	.3404	.0668	---	.34
II	502	.2380	.0867	.0306	.0467	.0141	.0332	.1352	.0802	---	.37
II	512	---	---	---	---	---	---	---	---	---	---
III	555	.3065	.1853	.0590	.0511	.0175	.1030	.2127	.0829	.28	.36
III	548	---	---	---	---	---	---	---	---	---	.37
III	558	.2390	.1355	.0360	.0213	.0239	.0769	.2752	.0468	---	---
III	524	.3537	.1405	.0504	.0440	.0199	.0847	.2861	.1390	---	.32
III	509	.2356	.0981	.0363	.0287	.0119	.0473	.2115	.0732	---	---
III	500	---	---	---	---	---	---	---	---	---	---

*Chlorine and sulphur as determined in the fresh sample.

TABLE XI.—PERCENTAGE OF MINERAL ELEMENTS IN THE HIDE AND HAIR CALCULATED ON THE FAT-FREE BASIS

Group	No. of Steer	Percent- age of fat in sample	Na	K	Ca	Fe	Mg	P	Cl	S	Cl*	S*
I	556	2.15	.3230	.1458	.0457	.0453	.0167	.0943	.2811	.0627	---	.42
I	557	5.01	.2396	.1629	.0378	.0265	.0144	.0815	.2794	.0642	---	.33
I	547	1.83	.3152	.1711	.0433	.0261	.0167	.0861	.2823	.0607	---	---
I	527	11.86	.3756	.1865	.0571	.0419	.0281	.0857	.3449	.0557	---	.44
I	513	10.07	.2271	.1118	.0315	.0337	.0127	.0595	.2316	.0587	---	---
I	501	13.24	---	---	---	---	---	---	---	---	---	---
II	554	1.62	.3023	.1638	.0559	.0466	.0166	.0986	.1826	.0104	---	.39
II	552	1.53	.3057	.1598	.0461	.0542	.0153	.1009	.3080	.0636	---	.36
II	550	1.22	.2646	.1938	.0432	.0254	.0190	.0871	.3089	.0517	---	---
II	526	5.71	.3608	.1553	.0565	.0575	.0347	.0632	.3610	.0708	---	.36
II	502	3.10	.2431	.0885	.0313	.0477	.0146	.0339	.1381	.0819	---	.38
II	512	3.61	---	---	---	---	---	---	---	---	---	---
III	555	.76	.3088	.1867	.0595	.0515	.0176	.1038	.2143	.0835	.29	.36
III	548	.93	---	---	---	---	---	---	---	---	---	.36
III	558	1.08	.2416	.1370	.0364	.0215	.0242	.0777	.2782	.0473	---	---
III	524	1.81	.3602	.1431	.0513	.0448	.0203	.0863	.2914	.1416	---	.32
III	509	2.48	.2416	.1006	.0372	.0294	.0122	.0485	.2169	.0751	---	---
III	---	---	---	---	---	---	---	---	---	---	---	---
Avg.	500	1.32	---	---	---	---	---	---	.27	---	.29	.37

TABLE XII.—PERCENTAGE COMPOSITION OF THE ASH OF INTERNAL ORGANS

Group	No. of Steer	N ₂ O	K ₂ O	CaO	Fe ₂ O ₃	MgO	P ₂ O ₅	Cl	SO ₃	SiO ₂	CO ₂	Carbon	Sand	Total	Deduct O=Cl	Total
I	556	13.44	21.00	3.62	1.17	1.83	40.92	3.56	1.14	.45	tr.	13.52	1.82	102.45	.80	101.65
I	557	14.82	24.12	4.15	1.15	2.84	43.98	4.99	.60	4.01	.47	None	None	101.12	1.12	100.00
I	547	16.59	24.47	.92	1.29	2.35	40.17	2.10	.53	4.20	3.51	3.40	1.82	101.35	.47	100.88
I	527	12.87	23.32	3.97	2.53	2.33	36.94	1.16	8.63	.60	.09	6.37	5.14	103.94	.26	103.68
I	513	19.70	23.72	3.30	1.25	2.89	39.89	1.43	1.55	4.38	3.21	None	None	100.32	.32	100.00
II	501	15.87	23.07	2.23	1.67	1.85	40.01	3.96	.75	.62	.03	11.38	2.42	103.86	.89	102.97
II	554	17.32	21.64	3.29	.93	2.34	36.22	5.07	.75	12.84	.75	None	None	101.14	1.14	100.00
II	552	17.58	24.79	2.06	3.06	1.83	40.24	3.42	1.18	.46	.10	2.28	3.10	100.10	.77	99.33
II	526	15.75	18.48	2.64	1.15	1.80	35.33	3.31	2.70	.72	.04	3.23	17.17	102.30	.74	101.56
II	512	20.76	22.24	2.90	.77	2.54	40.95	1.72	1.97	2.99	3.44	None	None	100.28	.39	99.89
III	555	15.62	24.98	2.93	.15	3.09	39.17	4.30	3.02	.55	.03	6.00	1.82	101.66	.96	100.70
III	548	19.63	23.81	3.33	1.05	2.26	40.84	6.38	.63	3.07	.45	None	None	101.44	1.43	100.01
III	558	16.87	25.23	3.43	1.37	1.25	38.05	5.06	7.13	.67	None	.85	1.34	101.25	1.13	100.12
III	524	18.25	22.01	3.22	1.25	2.30	36.40	5.77	3.15	1.07	None	.37	7.41	101.19	1.30	99.89
III	509	22.01	23.17	2.74	.34	2.14	38.60	2.80	2.07	4.36	2.41	None	None	100.62	.63	99.99

TABLE XIII.—COMPOSITION OF THE ASH OF INTERNAL ORGANS CALCULATED ON THE CARBON-AND-SAND-FREE BASIS TO EXACTLY 100

Group	No. of Steer	Percentage of ash in sample	Na ₂ O	K ₂ O	CaO	Fe ₂ O ₃	MgO	P ₂ O ₅	Cl	SO ₃	SiO ₂	CO ₂	Total	Deduct O = Cl	Total
I	556	1.54	15.57	24.33	4.19	1.35	2.12	47.40	4.12	1.32	.52	---	100.92	.92	100
I	557	1.15	---	---	---	---	---	---	---	---	---	---	---	---	---
I	547	1.12	14.82	24.12	4.15	1.15	2.84	43.98	4.99	.60	4.01	.47	101.12	1.12	100
I	527	.89	17.34	25.58	.96	1.35	2.46	41.99	2.20	.56	4.39	3.66	100.48	.47	100
I	513	1.10	13.96	25.30	4.31	2.73	2.52	40.07	1.26	9.37	.65	.10	100.26	.26	100
I	501	.95	19.70	23.72	3.30	.25	2.89	39.89	1.43	1.55	4.38	3.21	100.32	.32	100
II	554	1.28	17.79	25.87	2.50	1.87	2.07	44.85	4.44	.84	.70	.03	101.00	1.00	100
II	552	1.13	---	---	---	---	---	---	---	---	---	---	---	---	---
II	550	1.21	17.32	21.64	3.29	.93	2.34	36.22	5.07	.75	12.84	.75	101.14	1.14	100
II	526	.92	18.60	26.23	2.75	3.24	1.93	42.58	3.62	1.25	.49	.11	100.77	.77	100
II	502	1.29	19.40	22.76	3.25	1.42	2.21	43.52	4.07	3.32	.89	.04	100.91	.91	100
II	512	.94	20.78	22.26	2.90	.77	2.54	40.99	1.72	1.98	2.99	3.45	100.38	.38	100
III	555	1.19	16.81	26.89	3.15	.16	3.32	42.17	4.62	3.25	.59	.03	101.03	1.03	100
III	548	1.15	---	---	---	---	---	---	---	---	---	---	---	---	---
III	558	1.08	19.63	23.81	3.33	1.05	2.26	40.84	6.38	.63	3.07	.45	101.44	1.43	100
III	524	1.00	17.22	25.76	3.50	1.40	1.28	38.85	5.17	7.28	.68	None	101.13	1.13	100
III	509	1.01	19.80	23.89	3.50	1.36	2.49	39.51	6.26	3.42	1.16	None	101.39	1.41	100
III	500	1.00	22.01	23.17	2.74	.34	2.14	38.60	2.80	2.07	4.36	2.41	100.63	.63	100

TABLE XIV.—PERCENTAGE OF MINERAL ELEMENTS IN THE INTERNAL ORGANS CALCULATED ON THE FRESH WEIGHT BASIS

Group	No. of Steer	Na	K	Ca	Fe	Mg	P	Cl	S	Cl*	S*
I	556	.1779	.3110	.0461	.0145	.0197	.3184	.0635	.0081	.17	---
I	557	---	---	---	---	---	---	---	---	---	---
I	547	.1232	.2242	.0332	.0090	.0192	.2149	.0559	.0027	---	---
I	527	.1145	.1890	.0061	.0084	.0132	.1630	.0195	.0020	---	.12
I	513	.1139	.2310	.0339	.0210	.0167	.1926	.0139	.0412	---	---
I	501	.1388	.1870	.0224	.0017	.0166	.1656	.0136	.0059	---	---
II	554	.1689	.2749	.0228	.0167	.0160	.2512	.0568	.0043	.17	.14
II	552	---	---	---	---	---	---	---	---	---	.18
II	550	.1554	.2173	.0284	.0078	.0171	.1911	.0613	.0036	---	---
II	526	.1269	.2003	.0181	.0208	.0107	.1709	.0333	.0046	---	---
II	502	.1857	.2437	.0299	.0128	.0172	.2453	.0525	.0171	---	---
II	512	.1449	.1737	.0195	.0050	.0144	.1681	.0162	.0074	---	---
III	555	.1484	.2656	.0270	.0132	.0238	.2193	.0550	.0155	.15	.16
III	548	---	---	---	---	---	---	---	---	.14	.16
III	558	.1573	.2135	.0257	.0080	.0147	.1924	.0689	.0027	---	---
III	524	.1278	.2138	.0250	.0098	.0077	.1695	.0517	.0291	---	.08
III	509	.1484	.2003	.0252	.0096	.0152	.1741	.0633	.0138	---	---
III	500	.1633	.1923	.0196	.0024	.0129	.1684	.0280	.0083	---	---
A	---	---	---	---	---	---	---	---	---	.10	---

*Chlorine and sulphur as determined in the fresh sample.

TABLE XV.—PERCENTAGE OF MINERAL ELEMENTS IN THE INTERNAL ORGANS CALCULATED ON THE FAT FREE BASIS

Group	Steer	Percent- age of fat in sample	Na	K	Ca	Fe	Mg	P	Cl	S	Cl*	S*
I	556	8.56	.1946	.3401	.0504	.0159	.0215	.3482	.0694	.0089	.19	---
I	557	9.34	---	---	---	---	---	---	---	---	---	---
I	547	9.14	.1356	.2468	.0365	.0091	.0211	.2365	.0615	.0030	---	---
I	527	16.84	.1377	.2273	.0073	.0101	.0159	.1960	.0234	.0024	---	.14
I	513	9.03	.1251	.2539	.0373	.0231	.0184	.2117	.0153	.0453	---	---
I	501	12.06	.1578	.2126	.0255	.0019	.0189	.1880	.0155	.0067	---	---
II	554	5.94	.1796	.2921	.0242	.0178	.0170	.2667	.0604	.0046	.18	.15
II	552	9.40	---	---	---	---	---	---	---	---	---	.20
II	550	10.96	.1745	.2440	.0319	.0088	.0192	.2146	.0688	.0040	---	---
II	526	10.98	.1426	.2250	.0203	.0234	.0120	.1920	.0374	.0052	---	---
II	502	6.15	.1979	.2597	.0319	.0136	.0183	.2615	.0559	.0182	---	---
II	512	9.89	.1608	.1928	.0216	.0055	.0160	.1865	.0180	.0082	---	---
III	555	5.27	.1567	.2804	.0285	.0139	.0251	.2315	.0581	.0164	.16	.17
III	548	3.84	---	---	---	---	---	---	---	---	.15	.17
III	558	5.47	.1664	.2259	.0272	.0085	.0156	.2035	.0729	.0029	---	---
III	524	8.57	.1398	.2338	.0273	.0107	.0084	.1854	.0565	.0318	---	.09
III	509	10.58	.1660	.2240	.0282	.0107	.0170	.1947	.0708	.0154	---	---
III	500	9.29	.1800	.2120	.0216	.0026	.0142	.1856	.0309	.0092	---	---
A	---	---	---	---	---	---	---	---	---	---	.16	.15
Avg.	---	---	---	---	---	---	---	---	---	---	.17	.15

*Chlorine and sulphur as determined in the fresh sample.

TABLE XVI.—PERCENTAGE COMPOSITION OF THE ASH OF BLOOD

[illegible]

TABLE XVIII.—PERCENTAGE OF MINERAL ELEMENTS IN THE BLOOD CALCULATED ON THE FRESH WEIGHT BASIS

Group	No. of Steer	Na	K	Ca	Fe	Mg	P	Cl	S	Cl*	S*
I	556	.2427	.0271	.0069	.0536	.0026	.0226	.2385	.0298	.25	.17
I	557	.2448	.0513	.0108	.0539	.0081	.0166	.2497	.0327	.30	.13
I	547	.2163	.0447	.0069	.0336	.0043	.0185	.2398	.0217	---	---
I	527	---	---	---	---	---	---	---	---	---	---
I	513	.2059	.0446	.0067	.0404	.0042	.0164	.2190	.0362	---	---
I	501	---	---	---	---	---	---	---	---	---	---
II	554	.2310	.0289	.0074	.0513	.0025	.0211	.2909	.0247	---	.21
II	552	.2545	.0443	.0110	.0366	.0044	.0244	.2733	.0344	---	.11
II	550	.2006	.0343	.0049	.0261	.0039	.0156	.2043	.0105	---	---
II	526	---	---	---	---	---	---	---	---	---	---
II	502	.1666	.0915	.0066	.0579	.0035	.0134	.2148	.0316	---	---
II	512	---	---	---	---	---	---	---	---	---	---
III	555	.2262	.0356	.0068	.0487	.0039	.0205	.2174	.0267	.25	.17
III	548	---	---	---	---	---	---	---	---	.24	.14
III	558	.2301	.0291	.0069	.0274	.0048	.0182	.2436	.0134	---	---
III	524	---	---	---	---	---	---	---	---	---	---
III	500	---	---	---	---	---	---	---	---	---	---
III	509	.1913	.0462	.0063	.0527	.0033	.0182	.2049	.0416	---	---
Avg.	---	---	---	---	---	---	---	---	---	.26	.16

*Chlorine and sulphur as determined in the fresh sample.

TABLE XIX.—PERCENTAGE COMPOSITION OF THE ASH OF THE SKELETON

Group	No. of Steer	Percentage of ash in sample	Na ₂ O	K ₂ O	CaO	Fe ₂ O ₃	MgO	P ₂ O ₅	Cl	SO ₃	SiO ₂	CO ₂	Total	Deduct O=Cl	Total
I	556	17.52	2.94	.61	51.04	.130	1.17	40.76	.79	1.29	.26	1.03	100.03	.18	99.85
I	557	18.77	---	---	---	.119	---	---	---	---	---	---	---	---	---
I	547	18.86	3.89	.81	50.33	.101	1.65	40.27	.57	.97	tr.	.54	99.13	.13	99.00
I	527	25.27	---	---	---	.177	---	---	---	---	---	---	---	---	---
I	513	25.14	---	---	---	---	---	---	---	---	---	---	---	---	---
I	501	26.34	1.76	.32	52.81	.063	1.43	40.96	.43	.65	tr.	1.13	99.55	---	99.45
II	554	16.20	2.76	.85	50.30	.087	1.30	40.58	.88	.15	.29	1.98	99.18	.10	98.98
II	552	18.68	---	---	---	.075	---	---	---	---	---	---	---	.20	---
II	550	17.86	---	.93	50.02	.111	1.70	40.96	.58	1.13	tr.	tr.	99.07	.13	98.94
II	526	24.16	2.25	.57	52.47	.120	1.14	40.49	.46	.84	.14	1.08	99.56	.10	99.46
II	502	24.89	---	---	---	---	---	---	---	---	---	---	---	---	---
II	512	25.62	2.26	.34	52.41	.040	1.69	40.31	.40	.75	tr.	---	99.28	.09	99.19
III	555	14.34	3.15	.86	50.87	.103	1.15	40.38	1.07	1.81	.23	1.07	100.70	.24	100.46
III	548	16.87	2.68	.69	51.11	.139	1.60	40.63	.78	.95	.32	1.97	100.87	.17	100.70
III	558	17.00	2.76	.75	51.00	.047	1.72	41.19	.71	.90	tr.	.50	99.57	.16	99.41
III	524	23.37	2.31	.60	52.49	.120	1.16	40.95	.52	.67	.11	1.16	100.86	.12	100.74
III	509	24.78	---	---	---	.047	---	---	---	---	---	---	---	---	---
III	500	23.55	2.30	.60	52.33	.075	1.18	40.14	.39	.93	tr.	1.77	99.71	.09	99.62

TABLE XX.—PERCENTAGE OF MINERAL ELEMENTS IN THE SKELETON CALCULATED ON THE FRESH WEIGHT BASIS

Group	No. of Steer	Na	K	Ca	Fe	Mg	P	Cl	S	Cl*	S*
I	556	.382	.089	6.390	.0159	.1237	3.115	.1391	.0894	---	.19
I	557	---	---	---	.0156	---	---	---	---	.12	.13
I	547	.543	.127	6.783	.0133	.1881	3.313	.1079	.0728	---	---
I	527	---	---	---	.0313	---	---	---	---	---	.12
I	513	---	---	---	---	---	---	---	---	---	---
I	501	.344	.069	9.940	.0116	.2271	4.706	---	---	---	---
II	554	.331	.114	5.823	.0099	.1272	2.868	.1125	.0683	---	.12
II	552	---	---	---	.0098	---	---	.1429	.0940	---	.12
II	550	.482	.138	6.384	.0139	.1831	3.192	.1032	.0804	---	---
II	526	.403	.114	9.059	.0203	.1658	4.267	.1111	.0812	---	.12
II	502	---	---	---	---	---	---	---	---	---	---
II	512	.430	.073	9.596	.0071	.2607	4.505	.1025	.0763	---	---
III	555	.334	.103	5.213	.0103	.0994	2.526	.1539	.1038	.15	.19
III	548	.335	.097	6.161	.0164	.1630	2.990	.1307	.0641	.14	.14
III	558	.348	.106	6.195	.0056	.1765	3.054	.1205	.0613	---	---
III	524	.400	.116	8.766	.0196	.1638	4.175	.1206	.0626	---	.18
III	509	---	---	---	.0082	---	---	---	---	---	---
III	500	.401	.117	8.806	.0124	.1679	4.123	.0923	.0876	---	---

*Chlorine and sulphur as determined in the fresh sample.

TABLE XXI.—PERCENTAGE OF MINERAL ELEMENTS IN THE SKELETON CALCULATED ON THE FAT-FREE BASIS

Group	No. of Steer	Percent- age of fat in bone	Na	K	Ca	Fe	Mg	P	Cl	S	Cl*	S*
I	556	14.37	.446	.104	7.462	.0186	.1445	3.638	.1624	.1044	---	.22
I	557	15.20	---	---	---	.0184	---	---	---	---	.14	.15
I	547	16.29	.649	.152	8.106	.0159	.2247	3.958	.1289	.0870	---	---
I	527	23.73	---	---	---	.0410	---	---	---	---	---	.16
I	513	20.30	---	---	---	---	---	---	---	---	---	---
I	501	17.72	.418	.084	12.081	.0141	.2762	5.720	.1368	.0830	---	---
II	554	13.30	.382	.132	6.717	.0114	.1467	3.308	.1648	.1084	---	.14
II	552	15.87	---	---	---	.0116	---	---	---	---	---	.14
II	550	17.91	.587	.168	7.778	.0169	.2231	3.889	.1257	.0980	---	---
II	526	19.67	.502	.142	11.277	.0253	.2064	5.311	.1383	.1011	---	.15
II	502	19.18	---	---	---	---	---	---	---	---	---	---
II	512	20.31	.540	.092	12.041	.0089	.3272	5.652	.1286	.0957	---	---
III	555	7.97	.363	.112	5.662	.0112	.1080	2.745	.1672	.1128	.16	.21
III	548	15.25	.395	.115	7.269	.0194	.1924	3.528	.1542	.0756	.17	.17
III	558	19.32	.431	.131	7.680	.0069	.2188	3.786	.1494	.0760	---	---
III	524	18.10	.488	.142	10.700	.0239	.2000	5.098	.1472	.0764	---	.22
III	509	18.43	---	---	---	.0101	---	---	---	---	---	---
III	500	22.09	.515	.150	11.309	.0159	.2155	5.291	.1185	.1125	---	---
Avg.	---	---	---	---	---	---	---	---	---	---	.16	.17

*Chlorine and sulphur as determined in the fresh sample.

TABLE XXII.—WEIGHT IN GRAMS OF THE MINERAL ELEMENTS IN EACH TISSUE

Animal, age, group, and parts analyzed	Wt. of tissue in grams	Na	K	Ca	Fe	Mg	P	Cl	S	Cl ^a	S ^a
No. 556, 3 Mos. Group I.											
Lean and Fat	45,182	42,290	158,995	2,575	3,659	12,922	84,128	30,182	7,410	35.7	65.7
Hide and Hair	10,314	32,592	14,718	4,610	4,569	1,681	9,519	28,374	6,333	29.3	37.3
Internal Organs	12,890	22,931	40,088	5,942	1,869	2,539	41,041	8,185	1,044	20.0	17.7
Blood	6,124	14,863	1,659	0,423	3,282	0,159	1,384	14,606	1,825	15.9	9.8
Skeleton	20,754	79,280	18,471	1326,180	3,299	25,673	646,487	28,869	18,554	28.4	30.2
Warm Empty Wt.	98,133	91,956	233,931	1339,730	16,678	42,974	782,559	110,216	35,165	129.3	160.7
No. 557, 5 Mo. Group I.											
Lean and Fat	91,028	74,552	228,935	9,831	3,368	9,285	129,624	50,065	9,919	59.5	109.5
Hide and Hair	14,100	32,092	21,812	5,062	3,553	1,932	10,913	37,421	8,601	38.8	49.6
Internal Organs ^b	26,588	47,300	82,689	12,257	3,855	5,238	84,656	16,883	2,154	41.0	36.2
Blood	8,952	21,914	4,592	0,967	4,825	0,725	1,486	22,353	2,927	23.3	14.3
Skeleton ^b	29,410	112,346	26,175	1879,299	4,588	36,380	916,122	40,909	26,293	39.9	42.4
Warm Empty Wt.	172,797	288,204	364,203	1907,416	20,189	53,560	1142,801	167,631	49,894	202.5	252.0
No. 547, 8 Mos. Group I.											
Lean and Fat	94,790	72,325	253,184	12,891	3,412	16,683	139,056	51,091	2,559	67.7	124.5
Hair and Hide	14,618	45,243	24,558	6,213	3,742	2,368	12,352	40,521	8,712	41.6	53.1
Internal Organs	23,701	29,199	53,137	7,8687	2,133	4,5505	50,933	13,249	6,399	36.6	32.3
Blood	8,711	18,842	3,893	0,601	2,927	0,3746	1,6115	20,889	1,890	22.7	13.9
Skeleton	27,596	149,846	35,046	1871,837	3,670	51,908	914,255	29,776	20,089	37.0	39.3
Warm Empty Wt.	171,448	315,455	369,819	1899,411	15,884	75,885	1118,208	155,526	39,649	205.6	263.1

^aChlorine and sulphur as determined in the fresh material.^bCalculated from analysis of No. 556.

TABLE XXII (CONTINUED).—WEIGHT IN GRAMS OF THE MINERAL ELEMENTS IN EACH TISSUE

Animal, age, group, and parts analyzed	Wt. of tissue in grams	Na	K	Ca	Fe	Mg	P	Cl	S	Cl ^a	S ^a
No. 527, 40 Mos. Group I.											
Lean and Fat	522,642	268,638	739,538	29,791	19,338	62,194	419,682	95,121	7,317	219.2	403.1
Hair and Hide	46,240	153,100	76,019	23,304	17,063	11,468	34,911	140,569	22,704	118.2	150.8
Internal Organs	47,812	54,745	90,365	2,916	4,016	6,311	77,934	9,323	0,956	67.6	59.6
Blood ^b	27,382	56,379	12,212	1,834	11,062	1,150	4,491	59,967	9,912	71.2	43.8
Skeleton ^c	73,744	253,679	50,883	7330.154	23,082	167,473	3470.393	82,962	50,367	90.0	95.6
Warm Empty Weight	786,005	786,541	969,017	7388.000	74,561	248,596	4007.411	387,942	90,467	566.2	752.9
No. 513, 44 Mos., Group I.											
Lean and Fat	496,154	255,023	702,058	28,281	18,358	59,042	398,412	90,300	6,946	218.5	401.9
Hide and Hair	45,286	92,472	45,512	12,816	13,722	5,163	24,228	94,331	23,911	118.1	150.7
Internal Organs	48,968	55,775	113,116	16,600	10,283	8,178	94,312	6,807	20,175	75.7	66.8
Blood	25,680	52,875	11,453	1,721	10,375	1,079	4,212	56,239	9,296	66.8	41.1
Skeleton ^c	77,042	265,024	53,159	7657.975	8,937	174,962	3625.597	86,672	52,620	98.2	104.4
Warm Empty Weight	771,142	721,169	925,298	7717.395	61,675	248,424	4146.761	334,349	112,948	577.3	764.9
No. 501, 48 Mos. Group I.											
Lean and Fat	548,474	295,627	721,792	34,005	37,845	44,426	423,970	125,052	8,776	223.7	411.4
Hide and Hair	50,090	102,284	50,340	14,175	15,177	5,710	26,798	104,337	26,448	126.0	160.8
Internal Organs	47,332	65,697	88,511	10,602	0,805	7,857	78,382	6,437	2,793	70.8	62.4
Blood ^b	28,710	59,114	12,805	1,924	11,599	1,206	4,708	62,875	10,393	74.6	45.9
Skeleton	80,602	277,271	55,615	8011.839	9,350	183,047	3793.130	90,677	55,051	106.9	113.6
Warm Empty Weight	814,914	799,993	929,063	8072.545	74,776	242,246	4326.988	389,378	103,461	602.1	794.1

^aChlorine and sulphur as determined in the fresh material.^bCalculated from analysis of No. 513.^cCalculated from analysis of No. 501.

TABLE XXII (CONTINUED).—WEIGHT IN GRAMS OF THE MINERAL ELEMENTS IN EACH TISSUE

Animal, age, group, and parts analyzed	Wt. of tissue in grams	Na	K	Ca	Fe	Mg	P	Cl	S	Cl ^a	S ^a
No. 554, 3 Mos. Group II.											
Lean and Fat	36,840	41,371	126,951	6,483	1,916	7,810	72,391	26,967	2,247	30.1	55.4
Hide and Hair	7,400	22,008	11,921	4,070	3,389	1,206	7,178	13,290	7,548	21.1	26.9
Internal Organs	9,063	15,307	24,914	2,066	1,514	1,450	22,766	5,148	0,389	14.5	12.8
Blood	4,197	9,695	1,213	0,311	2,153	0,105	8,856	12,209	1,037	10.9	6.7
Skeleton	18,808	62,254	21,441	1095.190	1,862	23,924	539,413	26,877	17,679	26.1	27.7
Warm Empty Weight	78,071	150,635	186,340	1108.075	10,834	34,495	650,604	84,491	28,901	102.7	129.5
No. 552, 5 mos. Group II.											
Lean and Fat	47,818	33,999	117,967	7,747	3,108	5,356	67,041	19,988	1,674	37.7	69.3
Hide and Hair	10,532	31,701	16,577	4,782	5,624	1,590	10,469	31,944	6,593	30.1	38.4
Internal Organs ^b	12,485	21,087	34,321	2,847	2,085	1,998	31,362	7,091	0,537	19.2	17.0
Blood	5,219	13,282	2,312	0,574	1,910	0,230	1,273	14,264	1,795	13.6	8.4
Skeleton ^b	21,304	70,516	24,287	1240.532	2,088	27,099	610,999	30,443	20,026	28.7	30.5
Warm Empty Weight	99,349	170,585	195,464	1256.482	14,815	36,273	721,144	103,730	30,625	129.3	163.6
No. 550, 8 mos. Group II.											
Lean and Fat	59,680	52,220	163,822	9,499	1,790	12,652	93,996	31,332	1,552	44.5	81.8
Hide and Hair	10,440	27,290	19,982	4,458	2,620	1,963	8,978	31,852	5,335	29.9	38.2
Internal Organs	17,694	27,496	38,449	5,025	1,380	3,026	33,813	10,846	0,637	26.8	23.6
Blood	7,080	14,202	2,428	0,347	1,848	0,276	1,104	14,464	0,743	18.4	11.3
Skeleton	23,340	112,499	32,209	1490.026	3,244	42,736	745,013	24,087	18,765	30.7	32.6
Warm Empty Weight	121,112	233,707	255,890	1509.355	10,882	60,653	882,904	112,581	27,032	150.3	187.5

^aChlorine and sulphur as determined in the fresh material^bCalculated from analysis of No. 554.

TABLE XXII (CONTINUED).—WEIGHT IN GRAMS OF THE MINERAL ELEMENTS IN EACH TISSUE

Animal, age, group, and parts analyzed	Wt. of tissue in grams	Na	K	Ca	Fe	Mg	P	Cl	S	Cl ^a	S ^a
No. 526, 40 Mos. Group II.											
Lean and Fat	241,518	183,071	602,104	17,389	16,182	48,545	324,359	91,540	6,038	162.0	298.0
Hair and Hide	35,732	121,560	52,312	19,045	19,367	11,684	21,296	121,632	23,869	97.7	124.7
Internal Organs	46,911	59,530	93,963	8,491	9,757	5,019	80,171	15,621	2,158	71.0	62.6
Blood	18,957	31,582	17,346	1,251	10,976	0,663	2,540	40,720	5,990	49.3	30.3
Skeleton	69,070	278,352	78,740	6257.051	14,021	114,518	2947.217	76,737	56,085	88.8	94.3
Warm Empty Weight	427,995	674,095	844,465	6303.227	70,303	180,429	3375.583	346,250	94,140	468.8	609.9
No. 502, 44 Mos. Group II.											
Lean and Fat	248,856	191,370	620,647	26,130	9,208	40,564	329,734	105,266	19,162	177.1	325.6
Hair and Hide	39,556	94,143	34,295	12,104	18,473	5,577	13,133	53,480	31,724	111.2	141.8
Internal Organs	36,679	68,113	89,387	10,967	4,694	6,309	89,974	19,256	6,272	58.5	51.6
Blood	19,728	32,867	18,051	1,302	11,423	0,690	2,644	42,376	6,234	51.3	31.6
Skeleton ^c	72,452	291,982	82,595	6563.427	14,708	120,125	3091.527	80,494	58,831	93.7	99.5
Warm Empty Weight	444,424	678,475	844,975	6613.930	58,507	173,265	3527.012	300,872	122,223	491.8	650.1
No. 512, 48 Mos. Group II.											
Lean and Fat	277,824	186,976	631,494	26,671	13,058	35,561	358,115	124,465	8,335	173.3	318.8
Hair and Hide ^b	41,268	98,218	35,779	12,628	19,272	5,819	13,701	55,794	33,097	115.4	147.2
Internal Organs	40,410	58,554	70,192	7,880	2,021	5,819	67,929	6,546	2,990	61.9	54.6
Blood ^b	24,176	40,277	22,121	1,596	13,998	0,846	3,240	51,930	7,640	62.9	38.7
Skeleton	80,428	345,840	58,712	7717.871	5,710	209,676	3623.281	82,439	61,367	102.6	109.0
Warm Empty Weight	493,877	729,865	818,298	7766.643	54,059	257,721	4066.266	321,174	113,429	516.1	668.3

^aChlorine and sulphur as determined in the fresh material.^bCalculated from analysis of No. 502^cCalculated from analysis of No. 526.

TABLE XXII (CONTINUED).—WEIGHT IN GRAMS OF THE MINERAL ELEMENTS IN EACH TISSUE

Animal, age, group, and parts analyzed	Wt. of tissue in grams	Na	K	Ca	Fe	Mg	P	Cl	S	Cl ^a	S ^a
No. 555, 3 Mos. Group III.											
Lean and Fat.....	33,028	29,692	103,608	5,218	1,156	7,233	60,738	24,309	2,048	27.8	51.1
Hide and Hair.....	6,580	20,168	12,193	3,882	3,362	1,152	6,777	13,996	5,455	18.9	24.2
Internal Organs.....	8,951	13,283	23,774	2,417	1,182	2,130	19,629	4,923	1,387	14.4	12.7
Blood.....	4,529	10,245	1,612	0,308	2,206	0,177	0,928	9,846	1,209	11.8	7.2
Skeleton.....	16,608	55,471	17,106	865,775	17,110	16,508	419,518	25,560	17,239	24.5	26.0
Warm Empty Weight.....	71,078	128,859	158,293	877,600	25,016	27,200	507,590	78,634	27,339	97.4	121.2
No. 548, 5 mos. Group III.											
Lean and Fat.....	39,854	38,021	121,674	6,097	1,993	4,982	69,147	22,876	3,148	33.0	60.8
Hide and Hair.....	8,358	19,976	11,325	3,009	1,780	1,998	6,427	23,001	3,912	24.0	30.6
Internal Organs ^b	10,490	16,501	22,396	2,696	0,839	1,542	20,183	7,228	0,283	17.1	15.1
Blood ^c	4,603	10,412	1,639	0,313	2,242	0,180	0,944	10,007	1,229	12.0	7.4
Skeleton.....	19,754	66,176	19,161	1217,044	3,240	32,199	590,645	25,818	12,662	26.8	28.5
Warm Empty Weight.....	85,988	151,086	176,195	1229,160	10,094	40,901	687,346	88,930	21,234	112.9	142.4
No. 558, 8 Mos., Group III.											
Lean and Fat.....	41,566	34,250	119,876	6,401	1,289	7,939	65,924	22,737	1,205	34.2	62.8
Hide and Hair.....	8,138	19,449	11,027	2,930	1,733	1,945	6,258	22,396	3,809	23.4	29.8
Internal Organs.....	11,957	18,808	25,528	3,073	0,957	1,757	23,005	8,238	0,323	19.2	17.0
Blood.....	4,666	10,736	1,358	0,322	0,957	0,224	0,849	11,366	0,625	12.1	7.5
Skeleton.....	21,360	74,332	22,642	1323,252	1,196	37,700	652,334	25,739	13,094	27.6	29.3
Warm Empty Weight.....	89,999	57,575	180,431	1335,978	6,453	49,566	748,370	90,476	19,056	116.5	146.4

^aChlorine and sulphur as determined in the fresh material.^bCalculated from analysis of No. 558.^cCalculated from analysis of No. 555.

TABLE XXII (CONTINUED).—WEIGHT IN GRAMS OF THE MINERAL ELEMENTS IN EACH TISSUE

Animal, age, group, and parts analyzed	Wt. of tissue in grams	Na	K	Ca	Fe	Mg	P	Cl	S	Cl ^a	S ^a
No. 524, 40 Mos. Group III.											
Lean and Fat	163, 036	121, 625	450, 632	23, 803	9, 782	31, 629	256, 129	66, 030	57, 063	129, 3	237.7
Hide and Hair	30, 092	106, 435	42, 279	15, 166	13, 240	5, 988	25, 488	86, 093	41, 828	85.7	109.3
Internal Organs	30, 837	39, 410	65, 930	7, 709	3, 022	2, 374	52, 269	15, 943	8, 974	47.9	42.3
Blood ^b	17, 019	32, 557	7, 863	1, 072	8, 969	0, 562	3, 097	34, 872	7, 080	44.3	27.2
Skeleton	63, 610	254, 440	73, 788	5576.053	12, 468	104, 193	2655.718	76, 714	39, 820	83.4	88.6
Warm Empty Weight	322, 234	554, 467	640, 492	5623.803	47, 481	144, 746	2992.701	272, 652	154, 765	390.6	505.1
No. 509, 44 mos. Group III.											
Lean and Fat	218, 132	166, 435	561, 690	14, 397	15, 706	22, 249	307, 129	114, 737	3, 0538	157.6	289.8
Hide and Hair	37, 614	88, 619	36, 899	13, 654	10, 795	4, 476	17, 791	79, 554	27, 533	106.4	135.7
Internal Organs	33, 938	50, 364	67, 978	8, 552	3, 258	5, 159	59, 086	21, 483	4, 683	51.6	45.5
Blood	18, 291	34, 991	8, 450	1, 152	9, 639	0, 604	3, 329	37, 478	7, 609	47.6	29.3
Skeleton ^c	64, 866	260, 112	75, 893	5712.100	5, 319	108, 910	2674.425	59, 871	56, 823	84.7	89.9
Warm Empty Weight	391, 461	600, 521	750, 910	5749.855	44, 717	141, 398	3061.790	313, 123	99, 702	447.9	590.2
No. 500, 48 Mos. Group III.											
Lean and Fat	217, 860	188, 013	565, 565	28, 322	12, 418	35, 729	328, 315	34, 858	7, 625	156.9	288.5
Hide and Hair ^b	35, 938	84, 670	35, 255	13, 045	10, 314	4, 277	16, 969	76, 009	26, 307	102.8	131.2
Internal Organs	36, 998	60, 418	71, 115	7, 252	0, 888	4, 773	62, 305	10, 359	3, 071	57.1	50.3
Blood ^b	21, 269	40, 688	9, 826	1, 340	11, 209	0, 702	3, 871	43, 580	8, 849	55.3	34.0
Skeleton	71, 408	286, 346	83, 547	6288.188	8, 855	119, 894	2944.152	65, 910	62, 553	89.0	94.6
Warm Empty Weight	407, 833	660, 135	765, 308	6338.147	43, 684	165, 375	3355.612	230, 716	108, 405	461.1	598.6

^aChlorine and sulphur as determined in the fresh material.^bCalculated from analysis of No. 509^cCalculated from analysis of No. 500.

TABLE XXIII.—PERCENTAGES OF MINERAL ELEMENTS IN THE EMPTY WEIGHT OF THE ANIMALS

No. of Steer	Age in months	Group	Na	K	Ca	Fe	Mg	P	Cl	S	Cl*	S*
556	3	I	.20	.24	1.37	.017	.044	.80	.110	.036	.13	.16
557	5	I	.17	.21	1.10	.017	.031	.66	.097	.029	.12	.15
547	8	I	.18	.22	1.11	.009	.044	.65	.091	.023	.12	.15
527	40	I	.10	.12	.94	.010	.032	.51	.049	.012	.07	.10
513	44	I	.09	.12	1.00	.008	.032	.54	.043	.015	.08	.10
501	48	I	.10	.11	.99	.009	.030	.53	.048	.013	.07	.10
554	3	II	.19	.24	1.42	.014	.044	.83	.110	.037	.13	.17
552	5	II	.17	.20	1.26	.015	.037	.73	.100	.031	.13	.17
550	8	II	.19	.21	1.25	.009	.050	.73	.090	.022	.12	.16
526	40	II	.16	.20	1.47	.016	.042	.79	.081	.022	.11	.14
502	44	II	.15	.19	1.49	.013	.039	.79	.068	.028	.11	.15
512	48	II	.15	.17	1.57	.011	.052	.82	.065	.023	.10	.14
555	3	III	.18	.22	1.23	.035	.038	.71	.110	.038	.14	.17
548	5	III	.18	.20	1.43	.012	.048	.80	.103	.025	.13	.16
558	8	III	.18	.20	1.48	.007	.055	.83	.101	.021	.13	.16
524	40	III	.17	.20	1.75	.015	.045	.93	.085	.048	.12	.16
509	44	III	.15	.19	1.47	.011	.036	.78	.080	.025	.11	.15
500	48	III	.16	.19	1.55	.011	.041	.82	.057	.027	.11	.15

*Chlorine and sulphur as determined in the fresh material.

